High-Resolution Chopper Spectrometer (PHAROS)

The high-resolution chopper spectrometer, PHAROS, is designed for low-angle studies such as neutron Brillouin scattering and magnetic excitations. The instrument provides 0.5% incident energy resolution for incident energies between 50 meV and 2 eV. The sample is positioned 20 m from the moderator, which is currently chilled water. Phase I is complete, and the spectrometer consists of an evacuated, shielded flight path for low-angle scattering ($1° < \phi < 10°$).

When Phase II is completed, the spectrometer will be a high-resolution, general-purpose chopper spectrometer with 10 m^2 of detectors covering scattering angles between -10° and 140°. PHAROS will then be able to accommodate the full range of inelastic-scattering experiments, including phonon densities of states, magnetic excitations, momentum distributions, crystal-field levels, chemical spectroscopy, and measurements of S(Q,ω) in disordered systems. In addition, the low-angle detectors will be available for use at distances between 4 and 10 m with scattering angles down to 0.65°, thus making it suitable for high-resolution inelastic studies at low Q.

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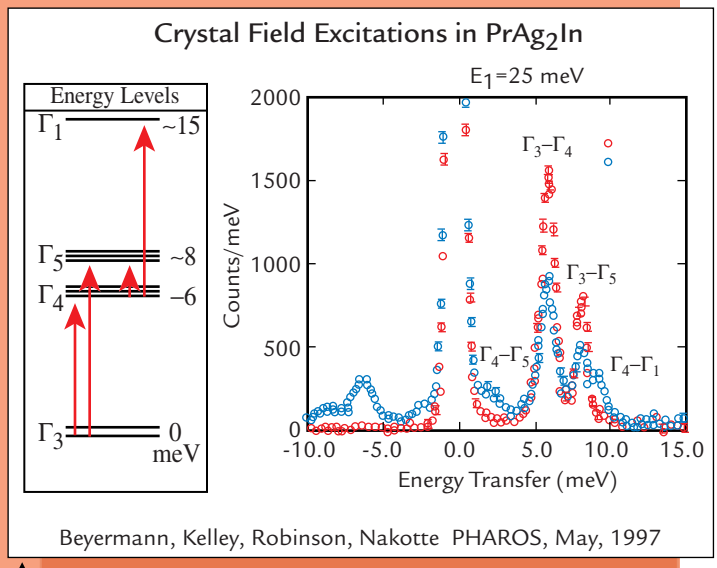
◀ Instrument scientist Rob McQueeney, on top of the PHAROS instrument, examines the vacuum pump.



▲ Ward Beyermann (UC Riverside) used inelastic-neutron-scattering measurements at 7 and 77 K on PHAROS to determine the crystal-electric fields level scheme of Pr^{3+}. The positions and intensities of the data on the right are associated with the level scheme on the left and identify the ground state. $PrAg_2In$ is an example of a new type of f-electron system where a non-magnetic interaction between conduction electrons and the ground state is responsible for its low-temperature behavior.

PHAROS Specifications	
Incident energy resolution	$\Delta E_i/E_i$ = 0.5%
Moderator-chopper distance	18 m
Chopper-sample distance	2 m
Moderator	Chilled water at 283K
Chopper frequency	60 - 600 Hz
Chopper diameter	10 cm
Chopper slit spacing	1 mm or more
Sample size	up to 5 cm x 7.5 cm
Detector (Phase I)	1 m^2 of detectors at 3.5 m from the sample; scattering angle between -10° and 10°
Detector (Phase II) Commissioning	9 m^2 of detectors at 4 m from the sample; scattering angle between -10° and 140°; 1 m^2 of detectors in forward scattering position at 4 to 10 m from the sample

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